



Log No. 206 Revised

~~7/29/21~~ 8/12/21

8/17/21

STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

Code being amended: ☒ Commercial Provisions ☐ Residential Provisions

Code Section # C403.4.11.1 & C406

Brief Description:

Revised for 8/20/2021 meeting after vote with the working group following amendments:

- Alternate requirements are clarified if HPWH proposal 21-GP1-136 is not included in the final WSEC; These markups were adjusted to not restrict the HPWH by use group.
- Load management credit exception for additions removed, as only LM required in new buildings.
- Ventilation shut off is removed from the dwelling unit HVAC control.
- Chiller efficiency improvement clarified as lessor of chiller OR rejection OR 20%.
- Residential lighting controls limited to dwelling units.
- Enhanced lighting control language clarified, and coordinated with combined proposal 124/126/178.
- Limited renewable credits to 50% of credit requirement as it was in last code cycle.
- Clarified wording in 3 load management credits.

For reference, track changes after the 8/13 vote is on: and are proposed amendments.

Revised for 8/13/2021 meeting with the following:

- Restructured the charging language to separate out area-weighted buildings. While there was a desire to get rid of exceptions, that exercise got tangled and the exceptions were reworded to be exceptions. The weighting language has been adjusted to match adopted proposal 230. Pulled this out into a separate subsection to improve clarity.
- Comments expressed concern that "Dwelling unit HVAC control" (C406.2.1) was in conflict with WSMC ventilation requirements. After review of the WSMC, here are the findings: C406 only relates to buildings greater than 3 floors, so the provisions in WSMC 403.8 do not apply. WSMC Section 403.3.1.3 "System Operation" allows actual ventilation to be based on the number of persons present. So, turning off ventilation in an unoccupied apartment is allowed. Even in WSMC 403.8, manual controls for ventilation are allowed.
- We did not include a suggestion for window switch controls on ventilation or heating/cooling, as there may be issues with longevity of the window switches, and we did not include this in the dwelling unit HVAC control measure. C403.4.1.6 requires sliding door switches.
- Where appropriate, "occupancy type" has been replaced with "occupancy group"
- A clarification for prior WSEC 2018 energy credits was added related to tenant spaces: Multiply by 6.

- HPWH revised to cover exceptions in base proposal and allow for contingent inclusion of base proposal as a credit if it is not passed.
- Service hot water thermostat balancing valves eliminated as redundant with proposal 175.
- The base DOAS and fan control option is removed. This is because the only use group it applied to was R-2 and those are likely to use a base DOAS or single zone ERV anyway.
- The high performance DOAS energy credits adjusted to match base adjustments in fan energy and HRV effectiveness requirements. These credits are reduced because the baseline fan allowance is now much more stringent. Retail increases from addition of a low lockout of bypass in the model as required in the measure.
- Added Fault detection and diagnostics (FDD) credit when applied and not otherwise required
- Added R-2 laundry appliance proposal using highest efficiency energy star [proposal 88].
- HVAC reset had a minimum ramp period added [proposal 107].
- Minor edits for clarity throughout. Additional minor clarification from Duane Jonlin, including a UEF rating option for heat pump water heaters.

Revised for 7/30/2021 meeting with the following:

- Credits adjusted for new 0.44 lb/kWh emission rate;
- SHW measure credits adjusted to reflect corrections in piping heat loss.
- Required credits adjusted to reflect new credits and relax requirement on multi-family so requirement can be met with all available credits excluding renewables and HPWH, as the credits for MF HPWH credits are high.
- Changes in the enhanced lighting controls section based on lighting designer feedback.
- Adds a SHW pipe down (right) -sizing measure for multi-family and hotels that covers the same idea as proposal 21-GP1-217 UPC peak demand pipe sizing.

This revision of section C406 accomplishes these aims:

- Seven new energy efficiency measures are added
- HVAC savings is more clearly split into heating, cooling, and TSPR approaches
- Minimum requirements for HVAC and service hot water energy recovery are reduced to allow more projects and equipment types to participate.
- The basis for credits is adjusted based on simulation of building occupancy group prototypes with energy efficiency measure credits based on Carbon emission values of 11.7 #/therm for natural gas and 0.4 #/kWh for electricity.
- The efficiency credit requirements are normalized to the credits required in the last cycle of WSEC, so there is no increase in the overall efficiency credit requirement. Credit requirements are now distinct by building type.
- Seven new load management measures are added with a separate load management requirement for new buildings. These prepare buildings to interact efficiently with the evolving electrical grid in the future. This is a new requirement and additional costs are justified.

Proposed code change text: (Copy the existing text from the Integrated Draft, linked above, and then use underline for new text and ~~strikeout~~ for text to be deleted.)

C403.4.11.1 DDC applications. DDC shall be provided in the applications and qualifications listed in Table C403.4.11.1 and for load management measures where installed to meet requirements of Section C406.3.

SECTION C406

EFFICIENCY AND LOAD MANAGEMENT MEASURES PACKAGES

C406.1 Additional energy efficiency and load management credit requirements. The project as defined in the building permit shall meet the following requirements as applicable:

1. New buildings, ~~and changes in space conditioning~~ space conditioning category, change of occupancy group, and building additions in accordance with Chapter 5 shall comply with sufficient ~~packages measures from Table~~ Section C406.2.4 so as to achieve a the minimum number of ~~six~~ required efficiency credits shown in Table C406.1.
2. New buildings greater than 5000 gross square feet of floor area shall comply with sufficient measures from Section C406.3 so as to achieve the minimum number of required load management credits shown in Table C406.1.
3. Tenant spaces shall comply in accordance with Section C406.1.1.
4. Projects using discrete area credit weighting shall comply in accordance with Section C406.1.2. ~~Each area shall be permitted to apply for different packages provided all areas in the building comply with the requirement for six credits. Areas included in the same permit within mixed-use buildings shall be permitted to demonstrate compliance by an area-weighted average number of credits by building occupancy achieving a minimum number of six credits.~~

Exceptions:

1. Low energy spaces in accordance with Section C402.1.1.1, ~~and equipment buildings in accordance with Section C402.1.2, unconditioned spaces, open parking garages, and enclosed parking garages shall that~~ comply with sufficient packages measures from Table C406.2.4 to achieve a minimum number of ~~three~~ 18 efficiency credits. Such projects shall be exempt from load management requirements in Table C406.1.
2. Building additions that have less than 1,000 square feet of *conditioned floor area* ~~shall that~~ comply with sufficient packages measures from Table C406.2.4 to achieve a minimum ~~number of three~~ 18 efficiency credits. ~~Such additions shall be exempt from load management credit requirements in Table C406.1.~~
3. Warehouses are exempt from load management credit requirements in Table C406.1.

TABLE C406.1
ENERGY MEASURE CREDIT REQUIREMENTS

Required Credits for projects	Section	Group R-1	Group R-2	Group B	Group E	Group M	All Other
New building energy efficiency credit requirement	C406.2	51 <u>46</u>	60 <u>35</u>	36	41	63	37
Building additions energy efficiency credit requirement	C406.2	25 <u>23</u>	30 <u>17</u>	18	20	31	18
<i>If proposal 21-GP1-136 is not included in the final WSEC, then replace the two rows above with the following:</i>							
<u>New building energy efficiency credit requirement</u>	<u>C406.2</u>	<u>51</u>	<u>60</u>	<u>36</u>	<u>41</u>	<u>63</u>	<u>37</u>
<u>Building additions energy efficiency credit requirement</u>	<u>C406.2</u>	<u>25</u>	<u>30</u>	<u>18</u>	<u>20</u>	<u>31</u>	<u>18</u>
New building load management credit requirement	C406.3	12	15	27	15	13	26

C406.1.1 Tenant spaces. An initial tenant improvement shall comply with sufficient ~~packages measures~~ from Table C406.24 to achieve a the minimum number of ~~six~~ 36 efficiency credits required in Table C406.1 and are not required to achieve any load management credits. In ~~buildings~~ projects with multiple tenant spaces, each tenant space is permitted to apply for different ~~packages measures~~ provided the weighted average of all areas in the ~~project building~~ comply with the overall efficiency credit requirement in Table C406.1. ~~for six credits.~~ Whole building or addition energy credits shall be allocated to tenant spaces in accordance with Sections C406.1.1.1 and C406.1.1.2.

Exceptions to C406.1.1:

1. An initial tenant improvement where the core and shell building complied via Section C407 in 2018 or later WSEC.
- 4.2. Previously occupied tenant spaces in existing buildings that comply with this code in accordance with Section C501.

C406.1.1.1 Applicable envelope and on-site renewable, and elevator energy credits.

Where an entire building or building addition complies with Section C406.2.45, C406.2.9, C406.2.10 or C406.2.14 44, under an initial tenant improvement permit, tenant spaces within the building qualify for the number of credits assigned to the occupancy ~~group type~~ of the tenant space in accordance with Table C406.24. Where prior energy credits were achieved under the 2018 WSEC, they shall be multiplied by 6 for applicability to this code.

C406.1.1.2 Applicable HVAC and service water heating credits. Where HVAC and service water heating systems and services are installed and comply with Section C406.2.2, C406.2.6, C406.2.7, or C406.2.8 under an initial tenant improvement permit, those systems and services shall be considered a part of the tenant space. Tenant spaces qualify for the credits assigned to the occupancy ~~group type~~ of the tenant space in accordance with Table C406.24 if the tenant space includes the distribution system and equipment that the central HVAC systems or service water heating systems were designed to support.

Exception: ~~Previously occupied tenant spaces in existing buildings that comply with~~

this code in accordance with Section C501.

C406.1.2 Discrete area-weighted projects. Discrete building areas shall be permitted to achieve credits using different measures provided that the whole project complies with both the energy and load management credit requirements. Compliance shall be determined as follows:

1. Project credit requirement shall be the individual occupancy group requirements from Table C406.1 for each discrete area weighted by discrete area conditioned floor area.
2. Determine the energy and load management credits achieved for each discrete area based on its occupancy group.
3. Determine project credits achieved by weighting individual discrete area credits by discrete area conditioned floor area.
4. A project complies when both energy and load management credits are equal to or greater than the weighted project requirement.

C406.2 Additional Energy Efficiency Credit Measures. Each energy efficiency credit measure used to meet credit requirements for the project shall include efficiency that is greater than the energy efficiency required for the building type and configuration requirements in Sections C402 through C405. Measures installed in the project that meet the requirements in Sections C406.2.1 through C406.2.14 shall achieve the credits listed for the measure and occupancy group in Table C406.2 or where calculations required by Sections C406.2.1 through C406.2.14 create or modify the table credits, the credits achieved shall be based upon the section calculations.

TABLE C406.4.2
EFFICIENCY PACKAGE MEASURE CREDITS

Code Section	Commercial Building Occupancy					
	Group R-1	Group R-2	Group B	Group E	Group M	All-Other
	Additional Efficiency Credits					
1. More efficient HVAC performance in accordance with Section C406.2.1	2.0	3.0	3.0	2.0	1.0	2.0
2. Reduced lighting power: Option 1 in accordance with Section C406.2.3.1	1.0	1.0	2.0	2.0	3.0	2.0
3. Reduced lighting power: Option 2 in accordance with Section C406.2.3.2 ^a	2.0	3.0	4.0	4.0	6.0	4.0
4. Enhanced lighting controls in accordance with Section C406.2.4	NA	NA	1.0	1.0	1.0	1.0
5. On-site supply of renewable energy in accordance with C406.2.5	3.0	3.0	3.0	3.0	3.0	3.0
6. Dedicated outdoor air system in accordance with Section C406.2.6 ^b	4.0	4.0	4.0	NA	NA	4.0
7. High performance dedicated outdoor air system in accordance with Section C406.2.7	4.0	4.0	4.0	4.0	4.0	4.0
8. High-efficiency service water heating in accordance with Sections C406.8.1 and C406.2.8.2	4.0	5.0	NA	NA	NA	8.0

9. High performance service water heating in multi-family buildings in accordance with Section C406.2.9	7.0	8.0	NA	NA	NA	NA
10. Enhanced envelope performance in accordance with Section C406.2.10 ⁶	3.0	6.0	3.0	3.0	3.0	4.0
11. Reduced air infiltration in accordance with Section C406.2.11 ⁶	1.0	2.0	1.0	1.0	1.0	1.0
12. Enhanced commercial kitchen equipment in accordance with Section C406.2.12	5.0	NA	NA	NA	5.0	5.0 (Group A-2 only)

Replace Table 406.2 with the following (not underlined for clarity):

Measure Title	Applicable Section	Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Dwelling unit HVAC control	C406.2.1	NA	7	NA	NA	NA	NA
2. Improved HVAC TSPR ^a	C406.2.2.1	NA	8	11	17	22	NA
3. Improve cooling and fan efficiency	C406.2.2.2	2	1	2	2	3	2
4. Improve heating efficiency	C406.2.2.3	2	3	3	10	16	7
5. High performance DOAS	C406.2.2.4	31	31	21	39	40	21 / (A) 40 ^b
6. Fault detection & diagnostics (FDD)	C406.2.2.5	2	2	2	6	9	4
7. 10% reduced lighting power	C406.2.3.1	7	4	18	16	20	15
8. 20% reduced lighting power ^c	C406.2.3.2	13	8	36	32	40	29
9. Lamp Efficacy Improvement	C406.2.3.3	5	6	NA	NA	NA	NA
10. Residential lighting control	C406.2.4.1	NA	8	NA	NA	NA	NA
11. Enhanced lighting control	C406.2.4.2	1	1	6	6	11	6
12. Onsite renewable energy	C406.2.5	7	12	13	13	10	11
13. Shower drain heat recovery	C406.2.6.1	9	30	NA	3	NA	NA
14. Service water heat recovery	C406.2.6.2	35	111	13	14	(Grocery) 41 ^d	NA
15. Heat Pump water heating	C406.2.6.3	NA	NA	17	33	(Grocery) 95 ^d	(A-2) 95 ^e
If proposal 21-GP1-136 is not included in the final WSEC, then replace the row above with the following:							
15. Heat Pump water heating	C406.2.6.3	81	261	17	33	(Grocery) 95 ^d	(A-2) 95 ^e
16. Heat trace system	C406.2.7.1	6	13	4	1	NA	26 6

17. Point of use water heater	C406.2.7.2	NA	NA	56 19	45 5	NA	NA
18. Service Hot Water Distribution Right Sizing	C406.2.8	13	42	NA	NA	NA	NA
19. Enhanced envelope performance ^f	C406.2.9	24	20	13	5	19	14
20. Reduced air infiltration ^f	C406.2.10	29	24	6	3	9	11
21. Enhanced commercial kitchen equipment	C406.2.11	NA	NA	NA	NA	NA	(A-2) 31 ^e
22. Enhanced residential kitchen equipment	C406.2.12	12	19	NA	NA	NA	NA
23. Enhanced residential laundry equipment	C406.2.13	NA	6	NA	NA	NA	NA
24. Efficient elevator equipment	C406.2.14	3	5	5	5	4	4

- Projects using ~~this option~~ Item 2 shall not use Items 3 through 5 2.
- For C406.2.2.4 occupancy Group A achieves 40 credits while other occupancy groups within the “all other” category achieve 21 credits.
- Projects using C406.2.3.2 shall not use C406.2.3.1.
- Service water heat recovery and heat pump water heating are available in Group M only for grocery stores larger than 10,000 square feet. Large mixed retail with full grocery and butcher sections shall achieve half the credits.
- Heat pump water heating and kitchen equipment efficiency credits are available in the “all other” category only for Group A-2.
- Buildings or building areas that are exempt from thermal envelope requirements in accordance with Sections C402.1.1 and C402.1.2 do not qualify for ~~this~~ these package measures.

C406.2.1 Dwelling Unit HVAC Control. HVAC systems serving *dwelling units* or *sleeping units* shall be controlled with a programmable thermostat that is configured to automatically activate a setback condition of at least 5°F (3°C) for both heating and cooling. The programmable thermostat shall be configured to provide setback during occupied sleep periods. ~~Where ventilation is provided by a separate system, it shall be turned off when the units are in unoccupied setback.~~ The unoccupied setback mode shall be configured to operate in conjunction with one of the following:

- A manual main control device by each *dwelling unit* main entrance that initiates setback ~~and non-ventilation mode~~ for all HVAC units in the dwelling unit and is clearly identified as “Heating/Cooling Master Setback.”
- Occupancy sensors in each room of the *dwelling unit* combined with a door switch to initiate setback ~~and non-ventilation mode~~ for all HVAC units in the dwelling within 20 minutes of all spaces being vacant immediately following a door switch operation. Where separate room HVAC units are used, an individual occupancy sensor on each unit that is configured to provide setback shall meet this requirement.
- An advanced learning thermostat that senses occupant presence and automatically creates a schedule for occupancy and provides a dynamic setback schedule based on when the spaces are generally unoccupied.
- An automated control and sensing system that uses geographic fencing connected to the dwelling unit occupants’ cell phones and initiates the setback condition when all occupants are away from the building.

C406.2.2 More efficient HVAC System Performance. All heating and cooling systems shall meet the minimum requirements of Section C403 and efficiency improvements shall be referenced to minimum efficiencies listed in Tables referenced by Section C403.3.2. Where multiple efficiency requirements are listed, equipment shall meet the seasonal efficiencies including SEER, EER/IEER, IPLV, or AFUE. Equipment that is larger than the maximum capacity range indicated in Tables referenced by Section C403.3.2 shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table. Where multiple individual heating or cooling systems serve the project, the improvement shall be the weighted average improvement based on individual system capacity.

For occupancies and systems required to comply with Section C403.1.1, credits are permitted to be achieved by meeting the requirements of C406.2.2.1. Other systems are permitted to achieve credits by meeting the requirements of either:

1. C406.2.2.2 More efficient HVAC equipment cooling and fan performance
2. C406.2.2.3 More efficient HVAC equipment heating performance
3. C406.2.2.4 High performance- dedicated outdoor air system (DOAS)
4. Any combination of C406.2.2.2, C406.2.2.3, and C406.2.2.4

In addition, energy credits are permitted to be achieved for C406.2.2.5- fault detection and diagnostics (FDD) where not otherwise required by Sections C403.2.3 or C403.6.10(15).

C406.2.2.1 Improved HVAC TSPR. For systems required to comply with Section C403.1.1, HVAC total system performance ratio, the TSPR shall exceed the minimum requirement by 5 percent. If improvement is greater, credits in Table C406.2 are permitted to be prorated up to a 20 percent improvement.

C406.2.2.2 More efficient HVAC equipment cooling and fan performance. No less than 90 percent of the total HVAC capacity serving the total conditioned floor area of the entire building, or tenant space in accordance with Section C406.1.1, shall comply with Sections C406.2.2.2.1 through C406.2.2.2.3. Where individual equipment efficiencies vary, weight them based on capacity. For systems required to comply with Section C403.1.1, HVAC total system performance ratio, exceed the minimum requirement by 10 percent.

Exception: In low energy spaces complying with Section C402.1.1 and semi-heated spaces complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Stand-alone supply, return and exhaust fans shall comply with Section C406.2.3.

C406.2.2.2.1 HVAC system selection. Equipment installed shall be types that are listed in Tables referenced by Section C403.3.2. (1) through C403.3.2(12) or a combination thereof. Electric resistance heating does not meet this requirement.

Exception: Allowed equipment not listed in Tables C403.3.2(1) through C403.3.2(12):

1. Air-to-water heat pumps.
2. Heat recovery chillers.

C406.2.2.2.2 Minimum Cooling Equipment efficiency. Equipment shall exceed the minimum cooling efficiency requirements listed in Tables referenced by Section C403.3.2(1) through C403.3.2(12) by at least 15 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all the requirements by 15 percent. Where equipment exceeds the minimum annual cooling efficiency and heat rejection efficiency requirements by more than 5 percent, energy efficiency credits for cooling shall be determined using Equation 4-C406.2.2.2, rounded to the nearest whole number.

$$EE_{CHEC} = EEC_5 \times [1 + ((CEI - 5 \text{ percent}) \div 5 \text{ percent})] \quad (\text{Equation 4-C406.2.2.2})$$

Where:

EE_{CHEC} = energy efficiency credits for cooling efficiency improvement

EEC_5 = C406.2.2.2 credits from Tables C406.2

CEI = the lesser of: the improvement above minimum cooling ~~efficiency requirements and~~, ~~minimum~~ heat rejection efficiency requirements, or 20 percent. Where cooling efficiency varies by system, use the capacity weighted average ~~percentage efficiency improvement~~ for all cooling equipment combined. ~~Where cooling rating reduces as efficiency increases, base the efficiency improvement on the inverse of the rating.~~

Exceptions:

1. ~~Equipment that is larger than the maximum capacity range indicated in Tables referenced by Section C403.3.2(1) through C403.3.2(12) shall utilize the values listed for the largest capacity equipment for the associated equipment type shown in the table.~~
2. ~~Equipment complying with the exception to Section C406.2.1 is not required to comply with the minimum equipment efficiency requirement.~~
3. ~~Compliance may be demonstrated by calculating a total weighted average percentage for all heating and cooling equipment combined. All equipment shall have efficiency that is no less than 5 percent better than the minimum required efficiency in Tables C403.3.2(1) through C403.3.2(12), and the resulting weighted average percentage for all equipment performance requirements shall exceed 15 percent. Calculation shall include heating and cooling capacities for all equipment, percentage better or worse than minimum required efficiency per Tables C403.3.2(1) through C403.3.2(12) for each performance requirement (SEER, EER/IEER, COP, HSPF, Et, Ec and AFUE), and the total weighted average efficiency percentage.~~
4. ~~Hot water boilers with input capacity greater than 2,500,000 Btu/h shall be considered to comply with this section with a minimum thermal efficiency of 95 percent Et per the test procedure in 10 CFR Part 431.~~

C406.2.2.2.3 Minimum fan efficiency. Where fan energy is not included in packaged equipment rating or it is and the fan size has been increased from the as-rated equipment condition, fan power or horsepower shall be less than 95 percent of the allowed fan power in Section C403.8.1, Allowable fan motor horsepower. ~~Stand-alone supply, return and exhaust fans designed for operating with motors over 750 watts (1 hp) shall have a fan efficiency grade of not less than FEG 71 as defined in AMCA 205. The total efficiency of the fan at the design point of operation shall be within 10 percentage points of either the maximum total efficiency of the fan or the static efficiency of the fan.~~

C406.2.2.3 More efficient HVAC equipment heating performance. No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, or tenant space in accordance with Section C406.1.1, shall comply with Sections C406.2.2.3.1 through C406.2.2.3.2

C406.2.2.3.1 HVAC system selection. Equipment installed shall be types that are listed in Tables referenced by Section C403.3.2. Electric resistance heating shall be limited to 20 percent of system capacity, with the exception of heat pump supplemental heating.

C406.2.2.3.2 Heating equipment efficiency. Equipment shall exceed the minimum heating efficiency requirements listed in Tables referenced by Section C403.3.2 by at least 5 percent. Where equipment exceeds the minimum annual heating efficiency requirements by more than 5 percent, energy efficiency credits for heating shall be determined using Equation 4-C406.2.2.3 rounded to the nearest whole number.

$$EE_{CHEH} = EEC_5 \times [1 + ((CEI - 5 \text{ percent}) \div 5 \text{ percent})] \quad (\text{Equation 4-C406.2.2.3})$$

Where:

EEC_{HEH} = energy efficiency credits for heating efficiency improvement

EEC₅ = C406.2.2.3 credits from Tables C406.2

CEI = the lesser of: the improvement above minimum heating efficiency requirements, or 20 percent. Where heating efficiency varies by system, use the capacity weighted average percentage for all heating equipment combined.

Exception to C406.2.2.3.2: In low energy spaces complying with Section C402.1.1 and semi-heated spaces complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Such spaces shall achieve credits for EEC₅.

C406.2.2.4 High performance dedicated outdoor air system (DOAS). No less than 90 percent of the total conditioned floor area of the whole project, excluding floor area of unoccupied spaces that do not require ventilation per the *International Mechanical Code*, shall be served by DOAS installed in accordance with Section C403.3.5 with the following adjustments:

1. Minimum heat recovery sensible effectiveness of 80 percent, calculated in accordance with Section C403.3.5.1.
2. Where design outdoor airflow is greater than 500 cfm (250 L/s), the DOAS shall be equipped with an economizer bypass, damper control, or wheel speed control that is active between 55°F (12°C) and 75°F (24°C) and minimizes energy recovery or maintains an appropriate DOAS leaving air temperature when the building is generally in cooling, based either on outdoor air temperature or a DDC zone-based cooling system reset.
3. DOAS total combined fan power shall be less than either:
 - 3.1. 0.769 W/cfm (1.55 W/L/s) when calculated in accordance with Section C403.3.5.2, or
 - 3.2. 80% of fan power allowance for a constant volume system when calculated in accordance with Section C403.8.1

C406.2.2.5 Fault detection and diagnostics system. A project not required to comply with C403.2.3 or C403.6.10(15) shall achieve energy credits for installing a fault detection and diagnostics system to monitor the HVAC system's performance and automatically identify faults. The installed system shall comply with items 1 through 6 in Section C403.2.3.

C406.2.3 Reduced lighting power. Interior lighting within the whole project building, building addition or tenant space shall achieve credits by complying with Section C406.2.3.1 or C406.2.3.2. In R-1 and R-2 occupancies, lighting power reduction applies only to common areas not part of dwelling units or sleeping units and the credit applies to the entire R-1 or R-2 occupancy group area. Dwelling units and sleeping units within the building shall achieve credits by complying with Section C406.2.3.3.

C406.2.3.1 Reduced lighting power option 1. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 90 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types, or by using 90 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.2 Reduced lighting power option 2. The total connected interior lighting power calculated in accordance with Section C405.4.1 shall be 80 percent or less of the lighting power values specified in Table C405.4.2(1) times the floor area for the building types, or by using 80 percent or less of the total interior lighting power allowance calculated in accordance with Section C405.4.2.

C406.2.3.3 Lamp efficacy fraction. No less than 95 percent of the permanently installed light fixtures in dwelling units and sleeping units shall be provided by high efficacy lamps with a

minimum efficacy of 65 90 lumens per watt.

C406.2.4 Lighting Controls. For buildings with *nontransient residential spaces* energy credits shall be achieved by installation of systems meeting Section C406.2.4.1. Where non-dwelling unit spaces are not controlled under Section C406.2.4.1(a) only 66 percent of the credits shall be achieved. All other buildings shall achieve energy credits ~~by meeting requirements of in accordance with Section~~ C406.2.4.2. For buildings with mixed occupancies, credits shall be prorated based on floor area.

C406.2.4.1 Residential Building Lighting Control. In *buildings with nontransient residential spaces* lighting controls shall be ~~capable of and~~ configured to meet the following:

- a. ~~Stairwells, lobbies, and corridors shall have automatic partial OFF controls that shall reduce general lighting power in the space by at least 66% of full lighting power within 15 minutes of all occupants leaving the space.~~
 1. Each *dwelling unit* shall have a main control by the main entrance that turns off all the lights and all switched receptacles in the dwelling unit. ~~Switched receptacles shall be clearly identified and all switched receptacles shall be located within 12 inches of an unswitched receptacle.~~ The main control shall be permitted to have two controls, one for permanently wired lighting and one for switched receptacles. The main controls should be clearly identified as "lights master off" and "outlets master off".
 - 1-2. Switched receptacles shall be clearly identified and all switched receptacles shall be located within 12 inches of an unswitched receptacle.

C406.2.4.2 Enhanced digital lighting controls. ~~N~~ Measure credits shall be achieved where no less than 90 50 percent of the gross floor area interior lighting power within the whole project building, building addition or tenant space ~~has luminaires and lighting controls that include high end trim in compliance with Section C405.2.3 and either luminaire level lighting controls in compliance with Section C405.2.7.1 or networked lighting controls in accordance with Section C405.2.7.2. shall comply with Sections C406.4.2.1 and C406.4.2.2.~~ Where *general lighting* in more than 50 percent of the gross lighted floor area ~~receives high-end trim~~ complies, the base credits from Table C406.2 shall be prorated as follows:

$$[\text{Tuned lighted floor area, \%}] \times [\text{Base energy credits for C406.2.4.2}] / 50\%$$

If combined proposals 124/126/178 are not included in the WSEC code, then the highlighted text below shall be included here and replace the paragraph above.

If another proposal relocates the following subsections to C405.2; then, remove from C406 and change the references above.

C406.2.4.2 Enhanced digital lighting controls. ~~N~~ Measure credits shall be achieved where no less than 90 50 percent of the gross floor area interior lighting power within the whole project building, building addition or tenant space ~~has luminaires and lighting controls that include high end trim in compliance with Section C406.2.4.2.2 and either luminaire level lighting controls in compliance with Section C405.2.7.1 or networked lighting controls in accordance with Section C406.2.4.2.1. Where general lighting in more than 50 percent of the gross lighted floor area complies, the base credits from Table C406.2 shall be prorated as follows.~~

$$[\text{Tuned lighted floor area, \%}] \times [\text{Base energy credits for C406.2.4.2}] / 50\%$$

C406.2.4.2.1 Networked Lighting controls (NLC) function. Interior general lighting shall be located, scheduled and operated in accordance with Sections C405.2.1 through C405.8. In addition, ~~each NLC luminaire~~ shall be ~~controlled by NLC and shall be independently configured~~ to with the following enhanced control functions:

1. Luminaires shall be configured for Provide continuous full-range dimming.

2. Each luminaire shall be individually addressed.

Exceptions to Item 2:

1. Multiple luminaires mounted on no more than 12 linear feet of a single lighting track and addressed as a single luminaire.
2. Multiple linear luminaires that are ganged together to create the appearance of a single longer fixture and addressed as a single luminaire, where the total length of the combined luminaires is not more than 12 feet.
3. Monitor occupant activity to brighten or dim lighting when occupied or unoccupied respectively.
4. Monitor ambient light in primary and secondary daylight zones, both electric and daylight, and brighten or dim electric light to maintain target light level as indicated on Sequence of Operations.
5. Allow configuration and re-configuration of performance parameters for each control strategy including: high trim and low trim setpoints, timeouts, dimming fade rates, sensor sensitivity adjustment, and wireless zoning configuration.
6. Allow for demand response load shed.

1. No more than eight luminaires within a daylight zone are permitted to be controlled by a single daylight responsive control.

2. Luminaires shall be controlled by a digital control system configured with the following capabilities:

- 2.1. Scheduling and illumination levels of individual luminaires and groups of luminaires are capable of being reconfigured through the system.
- 2.2. Load shedding.
- 2.3. In open and enclosed offices, the illumination level of overhead general illumination luminaires are configured to be individually adjusted by occupants.
- 2.4. Occupancy sensors and daylight responsive controls are capable of being reconfigured through the system.

Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions required by this section.

C406.2.4.2.2 High-end trim. Luminaires ~~required to shall~~ have high end trim ~~and~~ shall be initially configured in accordance with the following:

1. The lighting control system shall be programmed to limit the initial maximum light output of individual luminaires or groups of luminaires to support visual needs of a space or area to meet the target light level documented in project Sequence of Operations.
2. Construction documents shall state that maximum light output or power input of controlled lighting shall be initially reduced, on average, to no more than 85 percent of full output. The average maximum light output or power of the controlled lighting shall be documented without high-end trim and with high-end trim to verify reduction of light output or power to no more than 85 percent when tuned.
3. High end trim power levels are allowed to be automatically reset where lumen maintenance control is used.
4. High-end trim and lumen maintenance controls shall be accessible only to authorized personnel.

C406.2.5 On-site renewable energy. Projects installing *on-site renewable energy* systems with a capacity of at least 0.1 watts per gross square foot (1.08 W/m²) of building area in addition to the *on-site renewable energy* capacity required elsewhere in this code, shall achieve energy credits for this measure. Renewable energy systems achieving energy credits shall not be used to satisfy other requirements of this code. Credits shall be prorated from the table value as follows:

$$AEC_{RRa} = AEC_{0.1} \times \frac{RR_t - RR_r}{0.1 \times PGFA}$$

Underline not shown in formula for clarity

Where:

AEC_{RRa} = C406.2.5 achieved energy credits for this project as calculated above, limited to 50% of the required credits in Section C406.1.

RR_t = actual total rating of on-site renewable energy systems (W)

RR_r = rating of *on-site renewable energy* systems required by other sections in this code or used to qualify for exceptions in this code (W)

$PGFA$ = Project *gross floor area*, ft^2

$AEC_{0.1}$ = C406.2.5 base credits from Table C406.2

Informative note:

Onsite renewable energy may include thermal service water heating or pool water heating in which case ratings in Btu/h can be converted to W where $W = Btu/h / 3.413$.

A whole building, building addition or tenant space shall be provided with on-site renewable energy systems with an annual production per square foot of no less than the value specified in Table C406.5 based on the total *conditioned floor area* of the whole building. The on-site renewable used in this option shall be separate from on-site renewables used as part of Section C406.7 or used to qualify for any exception in this code.

**TABLE C406.5
ON-SITE RENEWABLE ENERGY SYSTEM RATING (PER SQUARE FOOT)**

Building Area Type	kBTU per year	kWh per year
Assembly	1.8	0.53
Dining	10.7	3.14
Hospital	3.6	1.06
Hotel/Motel	2.0	0.59
Multi-family residential	0.50	0.15
Office	0.82	0.24
Other	2.02	0.59
Retail	1.34	0.38
School/University	1.17	0.34
Supermarket	5.0	1.47
Warehouse	0.43	0.13

~~C406.2.6 Dedicated outdoor air system (DOAS).~~ No less than 90 percent of the total *conditioned floor area* of the whole building, building addition or tenant space, excluding floor area of unoccupied spaces that do not require ventilation per the *International Mechanical Code*, shall be served by DOAS installed in accordance with Section C403.3.5. This option is not available to buildings subject to the prescriptive requirements of Section C403.3.5.

~~C406.2.7 High performance dedicated outdoor air system (DOAS).~~ A whole building, building addition or tenant space which includes a DOAS complying with Section C406.2.6 shall also

~~provide minimum sensible effectiveness of heat recovery of 80 percent and DOAS total combined fan power less than 0.5 W/cfm of outdoor air. For the purposes of this section, total combined fan power includes all supply, exhaust, recirculation and other fans utilized for the purpose of ventilation.~~

C406.2.68 Reduced energy use in service water heating. Buildings with service hot water heating equipment that serves the whole building, building addition or tenant space shall achieve credits through compliance with either

- ~~1. Sections C406.2.6.1, C406.2.6.2 or C406.2.6.3, 8.1 and/or C406.2.8.2 or C406.2.8.3.~~
- ~~2. Sections C406.2.6.1 and C406.2.6.2 or C406.2.6.3, 8.1 and/or C406.2.8.2 or C406.2.8.3.~~

C406.2.8.1 Building type. Not less than 90 percent of the ~~conditioned floor area~~ of the whole building, building addition or tenant space shall be of the following types:

- ~~1. Group R-1: Boarding houses, hotels or motels.~~
- ~~2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.~~
- ~~3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.~~
- ~~4. Group F: Laundries.~~
- ~~5. Group R-2.~~
- ~~6. Group A-3: Health clubs and spas.~~
- ~~7. Buildings with a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407 or as shown through alternate service hot water load calculations showing a minimum service water energy use of 15 k/Btu per square foot per year, as approved by the building official.~~

C406.2.6.1 Shower Drain Heat Recovery

Shower drain recovery units shall comply with C404.10 CSA B55.2 and preheat cold water supply to the showers. Potable waterside pressure loss shall be less than 100 psi (69 kPa) at maximum design flow. The efficiency of drain water heat recovery units shall be 54 percent in accordance with CSA B55.1. Full credits are applicable to the following building use types: multifamily, hotel, motel, dormitory, and schools with locker room showers. Where not all showers in the project have drain heat recovery, the credit is adjusted based on the following:

$$[C406.2.6.1 \text{ table credits}] \times [\text{showers with drain recovery}] / [\text{total showers}]$$

C406.82.6.2 ~~Load fraction~~ Service Water Heating Energy Recovery. Not less than ~~60~~ 30 percent of the annual service hot water heating energy use, or not less than ~~400~~ 70 percent of the annual service hot water heating energy use in buildings with water-cooled chiller systems subject to the requirements of Section ~~C403.9.5~~ **C403.9.2.1** or qualifying for one of its exceptions, shall be provided by one or more of the following:

~~Service hot water system delivering heating requirements using heat pump technology with a minimum COP of 3.0. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering water temperature of 74°F (23.3°C) or lower.~~

- ~~1. 2~~ Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or other *approved* system. Qualifying heat recovery must be above and beyond heat recovery required by other sections of this code.
- ~~2. 3~~ On site renewable energy water-heating systems where not used to meet other requirements or to obtain other energy credits.

~~C406.9 High performance service water heating in multifamily buildings.~~ For a whole building, building addition, or tenant space with not less than 90 percent of the conditioned floor area being Group R-2 occupancy, not less than 90 percent of the annual building service hot water energy use shall be provided by a heat pump system with a minimum COP of 3.0. This efficiency package ~~measure is allowed be taken in addition to Section C406.2.8.2.~~

C406.2.6.3 Heat Pump Service Water Heating. Projects ~~with Occupancy groups B, E, A-2 and grocery stores in group M~~ shall achieve credits through compliance with C406.2.6.3.1 ~~or C406.2.6.3.2.~~

~~{If proposal 21-GP1-136 does not pass is not included in the final WSEC, add the following the "or" language above:}~~

~~Projects with Occupancy groups R-1 and R-2 where all dwelling units or guest rooms in the project are served by a heat pump water system shall achieve credits through compliance with C406.2.6.3.2.~~

C406.2.6.3.1 Heat Pump Water Heater. Credits shall be achieved where service hot water system capacity is 82,000 Btu/h ~~s per hour~~ (24 kW) or less and is served using air-source heat pump technology with a minimum COP of 3.0 no more than 4.5 kW of resistance supplemental heating and meets one of the following:

1. The COP rating will be with a minimum COP of 3.0 and reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering water temperature of 74°F (23.3°C) or lower.
2. The Uniform Energy Factor (UEF) shall be a minimum of 3.40 rated based on U.S. Department of energy requirements.

~~The following credit shall be included for R-1 and R-2 occupancy group if proposal 21-GP1-136 is not adopted included in the WSEC as a prescriptive measure:~~

C406.2.6.3.2. Central Heat Pump Service Water Heating for Group R-1 and R-2 occupancies.

~~Energy credits shall be achieved by . . .~~

~~[include the heat pump water heater language requirements in proposal 136, Sections C402.2.1 through C402.1.5 (without exceptions and with required definitions) here]~~

C406.2.7 Improved Service Hot Water Temperature Maintenance. For buildings with gross floor area greater than 10,000 square feet, credits shall be achieved when hot water temperature maintenance is installed in accordance with one of the following:

C406.2.7.1 Self-regulated heat trace system. The credit achieved shall be from Table C406.2. This system shall include self-regulating electric heat cables, connection kits, and electronic controls. The cable shall be installed directly on the hot water supply pipes underneath the insulation to replace standby losses.

C406.2.7.2 Point of Use Water Heater. The credit achieved shall be from Table C406.2 where any fixtures requiring hot water shall be supplied from a localized electric source of hot water with no recirculation or heat trace and limited to 2kW and 6 gallons of storage. The supply pipe length from the point of use water heater to the termination of the fixture supply pipe shall be no more than 20 feet.

C406.2.8 Service Hot Water Distribution Right Sizing. To achieve this credit, where Group R-1 and R-2 occupancies are served by a central service hot water system, the distribution system serving dwelling units and guest rooms shall be sized using IAPMO/ANSI Uniform Plumbing Code UPC 1-2018, Appendix M. ~~IAPMO/ANSI WE•Stand – 2017 Water Efficiency and Sanitation Standard for the Built Environment.~~

Note: Consider including the following informative note or commentary to clarify the requirements of C406.2.8

Informative Note: Where the distribution sizing protocol is applied to other than multi-family residential buildings, a variance to the plumbing code may be needed. Note that UPC Appendix M is based on IAPMO/ANSI WE•Stand – 2017 Water Efficiency and Sanitation Standard for the Built Environment].

C406.2.9 40 Enhanced envelope performance. The Proposed Total UA of the thermal envelope of the ~~project whole building or building addition~~ shall be 15 percent lower than the Allowable Total UA for an area of identical configuration and fenestration area in accordance with Section C402.1.5 and Equation 4-2.

C406.2.10 44 Reduced air infiltration. Measured air infiltration of the total *conditioned floor area* of the whole building, fully isolated building addition or tenant space ~~shall comply with Section C406.11.1.~~

~~C406.11.1 Air leakage testing and verification.~~ Air infiltration shall be verified by whole building pressurization testing conducted in accordance with ASTM E779 or ASTM E1827 by an independent third party. The measured air leakage rate of the *building envelope* shall not exceed 0.17 cfm/ft² under a pressure differential of 0.3 in. water (75 Pa), with the calculated surface area being the sum of the above and below grade building envelope. A report that includes the tested surface area, floor area, air by volume, stories above grade, and leakage rates shall be submitted to the *code official* and the building owner.

Exception: Where the *conditioned floor area* of the building is not less than 250,000 ft² (25,000 m²), air leakage testing shall be permitted to be conducted on representative above grade sections of the building provided the *conditioned floor area* of tested areas is no less than 25 percent of the *conditioned floor area* of the building and are tested in accordance with this section.

C406.2.11 42 Enhanced commercial kitchen equipment. For buildings and spaces designated as Group A-2 or facilities whose primary business type involves the use of a commercial kitchen with at least one gas or electric fryer, all fryers, dishwashers, steam cookers and ovens shall comply with all of the following:

1. Achieve the ENERGY STAR label in accordance with the specifications current as of January 1, 2024.
2. Be installed prior to the issuance of the certificate of occupancy.
3. Have the ENERGY STAR qualified model number listed on the construction documents submitted for permitting.

C406.2.12 Residential Kitchen Equipment. For projects with Group R-1 and R-2 occupancies, energy credits shall be achieved where all dishwashers, refrigerators, and freezers comply with all of the following:

1. Achieve the Energy Star Most Efficient 2021 label in accordance with the specifications current as of:
 - a. Refrigerators and freezers 5.0, 9/15/2014
 - b. Dishwashers 6.0, 1/29/2016
2. Be installed prior to the issuance of the certificate of occupancy.

For Group R-1 where only some guest rooms are equipped with both refrigerators and dishwashers, the table credits shall be prorated as follows:

$$[C406.2.12 \text{ table credits}] \times [\text{floor area of guest rooms with kitchens}] / [\text{total guest room floor area}]$$

C406.2.13 Residential Laundry Appliances. For projects with Group R-2 occupancies, energy credits shall be achieved where all clothes washers and dryers in the projects meet the following requirements:

406.13.1. Each dwelling unit contains in-unit washer and dryer equipment that meets the following requirements:

1. Achieve the Energy Star Most Efficient label in accordance with the 2021 specifications.
2. Be installed prior to the issuance of the certificate of occupancy.

Where only some dwelling units are equipped with both washers and dryers, the table credits shall be prorated as follows:

$$[C406.2.13 \text{ table credits}] \times [\text{floor area of dwelling units with laundry}] / [\text{total dwelling unit floor area}]$$

C406.2.14 Efficient Elevator Equipment. Qualifying elevators in the building shall be Energy efficiency class A per ISO 25745-2, Table 7. Only buildings 3 or more floors above grade shall be permitted to use this credit. Credits shall be prorated based on equation C406.2.12, rounded to the nearest whole credit. Projects with a compliance ratio below 0.5 do not qualify for this credit.

$$EC_e = EC_t \times CR_e \quad (C406.2.12)$$

where:

EC_e = Elevator energy credit achieved for Building

EC_t = C406.2.12 Table energy credit

$$CR_e = \frac{F_A}{F_B}$$

F_A = Sum of floors served by class A elevators

F_B = Sum of floors served by all building elevators and escalators

C406.3 Load Management Credits. Load management measures installed in the building that meet the requirements in Sections C406.3.1 through C406.3.7 shall achieve the credits listed for the occupancy group in Table C406.2 or where calculations required by Sections C406.3.1 through C406.3.7 create or modify the table credits the credits achieved will be based upon the section calculations.

Each load management measure requires automatic controls activated by either utility demand response, utility price response signal, peak price period time control, or local building demand monitoring to be capable of performing the described load management practices. Controls shall be capable of and configured to provide the required load management sequences. The following additional control systems apply to these measures:

1. Where credit is taken for C406.3.6, Service Water Heating Energy Storage, the equipment shall be provided with controls that comply with ANSI/CTA-2045-B.
2. For other load management measures,
 - 2.1. Where the serving utility has a real-time demand response or pricing program, an interface compliant with serving utility requirements shall be installed.
 - 2.2. Where the serving utility does not have a real-time demand response or pricing program, a digital input to the system to support future utility programs shall be installed and building demand monitoring shall be installed and integrated into the load management sequence.
 - 2.3. All equipment involved in the required load management sequence shall have controls connected to a central DDC system.

TABLE C406.1.2
LOAD MANAGEMENT MEASURE CREDITS

Measure Title	Applicable Section	Group R-1	Group R-2	Group B	Group E	Group M	All Other
1. Lighting load management	C406.3.1	12	15	27	15	NA	NA
2. HVAC load management	C406.3.2	29	24	42	23	13	26
3. Automated shading	C406.3.3	NA	7	12	16	NA	NA
4. Electric energy storage	C406.3.4	41	50	126	72	37	65
5. Cooling energy storage	C406.3.5	13	10	14	19	NA	14
6. Service hot water energy storage	C406.3.6	31	248	59	8	5	70
7. Building thermal mass	C406.3.7	NA	NA	50	95	96	80

C406.3.1 Lighting Load Management. Automatic controls shall be capable of gradually reduce general lighting power with continuous dimming in 75% percent of the building area by at least 20% percent during peak demand periods. ~~Warehouse or retail storage building areas shall be permitted to switch off at least 25% of lighting power in 75% of the building area without dimming.~~ Where less than 75% percent, but at least 50% percent, of the building area lighting is controlled, the credits from Tables C406.2 shall be prorated as follows:

[Area of building with lighting load management, %] x [table credits for C406.3.1] / 75%

Exception: Warehouse or retail storage building areas shall be permitted to achieve this credit by switching off at least 25% percent of lighting power in 75% percent of the building area without dimming.

C406.3.2 HVAC Load Management. Automatic controls shall:

1. Where electric cooling is used, be configured to gradually increase over a minimum of three hours the cooling setpoint by at least 3°F over the course of the coincident summer peak building load and peak price or demand periods,
2. Where electric heating is used, be configured to gradually reduce over a minimum of three hours the heating setpoint by at least 3°F during winter peak pricing or building peak demand periods.

C406.3.3 Automated Shading Load Management. ~~Automatic~~ Where fenestration on south and west exposures exceeds 20% percent of wall area, automatic controls shall be ~~capable of~~ configured to operateing movable exterior shading devices or dynamic glazing to reduce solar gain through sunlit fenestration on southern and western exposures by at least 50% percent during electrical summer peak periods.

Informative note:

This credit can be met by exterior roller, movable blind, or movable shutter shading devices; however fixed overhang, screen or shutter shading will not meet the requirement. Roller shades that reject solar gain but still allow a view are allowed as long as they provide an effective 50% reduction in net solar gain, e.g., have a shading coefficient of less than 0.5 for the shading material itself. Interior shading devices will not meet the requirement. Electrochromatic windows that achieve 50% of SHGC would qualify.

C406.3.4 Electric Energy Storage. Automatic controls shall store electricity in electric storage devices during non-peak periods and use stored energy during peak periods to reduce building demand. Electric storage devices shall have a minimum capacity of 5 Wh/ft² (58 Wh/m²) of gross building area. For greater storage capacity up to 15 Wh/ft² (160 Wh/m²), credits shall be prorated as follows:

$$[\text{Installed electric storage capacity, Wh/ft}^2 \text{ (Wh/m}^2\text{)}] / 5 \text{ (58)} \times [\text{C406.3.4 Credits from Table C406.3}]$$

C406.3.5 Cooling Energy Storage. Automatic controls shall be capable of activating ice or chilled water storage to reduce electric demand during the hours of summer peak electric prices. Credits shown in table are based on storage capacity of 2 ton-hours per design day ton of cooling load with a 1.15 sizing factor. Credits shall be prorated for installed storage systems sized between 0.5 and 3.5 ton-hours per design day ton of cooling load rounded to the nearest whole credit. The storage tank shall have no more than 1.5% percent of storage capacity standby loss per day.

C406.3.6 SWH Energy Storage. To achieve this credit, where service hot water is heated by electricity, automatic controls activated by utility demand response signal, peak price period time control, or local building demand monitoring shall pre-heat stored service hot water before the peak price period and suspend electric water heating during the period of peak prices coincident with peak building load. Storage capacity shall be provided by either:

1. Preheating water above 140°F (60°C) delivery temperature with at least 1.34 kWh of energy storage per kW of water heating capacity. Tempering valves shall be provided at the water heater delivery location.
2. Providing additional heated water tank storage capacity above peak service hot water demand with equivalent peak storage capacity to item 1.

C406.3.7 Building Thermal Mass. To achieve this credit the building shall have both additional passive interior mass and a night-flush control of the HVAC system.

1. Interior to the building thermal envelope insulation, provide 15 pounds of passive thermal mass per square foot of building floor area. Mass construction shall be in the building interior and the indoor facing portion of the exterior wall, and interior floor construction. Mass construction shall have mass surfaces in direct contact with the air in conditioned spaces with directly attached wall board or hard surface flooring allowed. Mass with carpet or furred wallboard shall not be counted toward the building mass required. For Integral insulated concrete block walls complying with ASTM C90, only the mass of the interior face shall be counted toward the building mass required.
2. When summer mode is active and indoor average temperature is 5°F or more above outdoor temperature and between 10:00 pm and 6:00 am, automatic night flush controls shall operate outdoor air economizers at low fan speed less than 66% during the unoccupied period until the average indoor air temperature falls to the occupied heating setpoint. Summer mode shall be activated when outdoor air exceeds 70°F and continues until deactivated when outdoor air falls below 45°F. Another night flush strategy shall be permitted where demonstrated to be effective, avoids added morning heating, and is approved by the authority having jurisdiction.

Informative Note:

The simplified night flush sequence described will operate in "Summer Mode" below the 70°F OA trigger temperature down until OA of 45°F is hit when the "Summer Mode" is deactivated until the OA rises above 70°F again. Other strategies may be implemented that cool the space below the heating setpoint and adjust the morning heating setpoint to avoid morning reheating.

Purpose of code change:

Equivalent Energy Efficiency Credits

The code change adds new options for building developers to use in meeting the credit requirements. It makes these options more flexible and lowers the entry level for HVAC credits that have not been very useable in the past. Service hot water credits are expanded to allow application to more building use groups and reduce hot water temperature maintenance energy needed for legionella control.

The credits are calculated based on PNNL building prototypes and end uses adapted to baseline Washington state system types focusing generally on heat pumps. The credits are based on kWh and therm savings that are converted to carbon emission reduction values of 11.7 #/therm for natural gas and 0.4 #/kWh for electricity. The credits each represent 0.1% of emission reduction compared to total building baseline emissions.

To better match the ability to achieve savings for different use groups, the credit requirement is established by use group independently. The required credits are the same level of requirement as found in the 2019 WSEC. To arrive at this, the credits for several measures in the last code cycle (10% LPD reduction, 15% HVAC efficiency improvement, renewable PV, enhanced envelope performance, and reduced air infiltration) were added together and then compared to the new credits calculated with the carbon basis. Then these credits were both adjusted to the prior requirements, resulting in the current requirements matching the earlier code cycle.

As the overall code is reviewed by TAG and changes are made in the baseline, it may be necessary to revise the credits available and the requirements once the proposed changes are better understood.

New Load Management Credits

The load management credit requirements are the lesser of HVAC or lighting peak shedding controls. The purpose for adding the load management requirement is to encourage reducing and shifting building load in conjunction with increasing building efficiency. Load shifting measures require installing communication controls and programming to automatically reduce electric energy use during high demand periods. Thus, the load management credits take into account the time-sensitive value of efficiency and the ability to optimize energy use for grid services. It supports the state's objective to reduce building carbon emissions and will "future proof" buildings so they can respond to changing grid needs over time. The measure savings and corresponding credit values are based on electricity cost savings determined using the ASHRAE 90.-1 time-of-use rate, which was incorporated in the ASHRAE 90.1-2022 Work Plan as an optional rate to use to demonstrate the cost effectiveness of new code change proposals involving demand flexibility measures. Utilization of this representative US TOU rate, which results in similar annual electricity costs as the average national blended rate, is intended to serve as a proxy for valuing reduced grid impact, which accommodates increases in PV, regional growth, and other grid changes impacting peak periods over time.

The required load management credits are the lesser of either lighting control or HVAC setback/setup control during peak periods. HVAC time shift control is evaluated for cost effectiveness with the following results:

Load Management Credit Cost Effectiveness Calculation
Demand responsive HVAC Measure

	Floor Area	DR connectivity incremental cost	Annual Energy Cost Savings (\$/year)	Simple Payback (years)
ApartmentMidRise	33,741	\$ 2,780	\$ 736	3.8
Hospital	241,501	\$ 19,900	\$ 5,718	3.5
HotelSmall	43,202	\$ 3,560	\$ 1,181	3.0
OfficeMedium	53,628	\$ 4,419	\$ 2,146	2.1
OfficeSmall	5,503	\$ 453	\$ 117	3.9
RestaurantSitDown	5,502	\$ 453	\$ 416	1.1
RetailStripmall	22,500	\$ 1,854	\$ 342	5.4
SchoolPrimary	73,959	\$ 6,094	\$ 1,552	3.9
Warehouse	52,045	\$ 4,289	\$ 172	25.0

Reference: Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code, Nonresidential Grid Integration, Final CASE Report, August 2020

Demand Responsive Lighting – incremental costs per 10,000 sq. ft.

- 1) Connected Controls with Native OpenADR VEN => \$823
- 2) Piecemeal Connected Control System with Non-Native OpenADR VEN => \$826

Your amendment must meet one of the following criteria. Select at least one:

- ☐ Addresses a critical life/safety need.

☐ The amendment clarifies the intent or application of the code.

☒ Addresses a specific state policy or statute.
(Note that energy conservation is a state policy)

☐ Consistency with state or federal regulations.

☐ Addresses a unique character of the state.

☐ Corrects errors and omissions.

Check the building types that would be impacted by your code change:

- ☐ Single family/duplex/townhome

☐ Multi-family 1 – 3 stories

☒ Multi-family 4 + stories

☒ Commercial / Retail

☒ Institutional

☐ Industrial

Your name Reid Hart

Email address reid.hart@pnnl.gov

Your organization PNNL

Phone number 509-372-6215

Other contact name Mike Rosenberg

Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

The addition of new measures and reduced thresholds of existing measures is expected to potentially reduce the cost of compliance with the energy efficiency portion of Section C406. Because efficiency credits are equivalent, there are no anticipated changes in cost compared to the prior code cycle, so no cost effectiveness is included for this portion.

The required load management credits are the lessor of either lighting control or HVAC setback/setup control during peak periods. HVAC time shift control is evaluated for cost effectiveness with the following results:

Load Management Credit Cost Effectiveness Calculation Demand responsive HVAC Measure

	Floor Area	DR connectivity incremental cost	Annual Energy Cost Savings (\$/year)	Simple Payback (years)
ApartmentMidRise	33,741	\$ 2,780	\$ 736	3.8
Hospital	241,501	\$ 19,900	\$ 5,718	3.5
HotelSmall	43,202	\$ 3,560	\$ 1,181	3.0
OfficeMedium	53,628	\$ 4,419	\$ 2,146	2.1
OfficeSmall	5,503	\$ 453	\$ 117	3.9
RestaurantSitDown	5,502	\$ 453	\$ 416	1.1
RetailStripmall	22,500	\$ 1,854	\$ 342	5.4
SchoolPrimary	73,959	\$ 6,094	\$ 1,552	3.9
Warehouse	52,045	\$ 4,289	\$ 172	25.0

Reference: Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code, Nonresidential Grid Integration, Final CASE Report, August 2020

Demand Responsive Lighting – incremental costs per 10,000 sq. ft.

- 1) Connected Controls with Native OpenADR VEN => \$823
- 2) Piecemeal Connected Control System with Non-Native OpenADR VEN => \$826

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

\$0.0823/square foot (For residential projects, also provide [Click here to enter text.](#)/ dwelling unit)

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Show calculations here, and list sources for costs/savings, or attach backup data pages

Load Management Credit Cost Effectiveness Calculation
Demand responsive HVAC Measure

	Floor Area	DR connectivity incremental cost	Annual Energy Cost Savings (\$/year)	Simple Payback (years)
ApartmentMidRise	33,741	\$ 2,780	\$ 736	3.8
Hospital	241,501	\$ 19,900	\$ 5,718	3.5
HotelSmall	43,202	\$ 3,560	\$ 1,181	3.0
OfficeMedium	53,628	\$ 4,419	\$ 2,146	2.1
OfficeSmall	5,503	\$ 453	\$ 117	3.9
RestaurantSitDown	5,502	\$ 453	\$ 416	1.1
RetailStripmall	22,500	\$ 1,854	\$ 342	5.4
SchoolPrimary	73,959	\$ 6,094	\$ 1,552	3.9
Warehouse	52,045	\$ 4,289	\$ 172	25.0

Reference: Codes and Standards Enhancement (CASE) Initiative 2022 California Energy Code, Nonresidential Grid Integration, Final CASE Report, August 2020

Demand Responsive Lighting – incremental costs per 10,000 sq. ft.

- 1) Connected Controls with Native OpenADR VEN => \$823
- 2) Piecemeal Connected Control System with Non-Native OpenADR VEN => \$826

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

NA – Cost savings basis KWH/ square foot (or) [Click here to enter text](#).KBTU/ square foot

(For residential projects, also provide [Click here to enter text](#).KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

See above. Based on load management analysis or prototypes with WSEC baseline characteristics.

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

There should not be any additional plan review time.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.